

are produced simultaneously; the *Gradatæ*, in which there is a definite succession in time and space; and the *Mixtæ*, in which there is a succession in time, but no regular succession in space.

"These three types appeared successively in geological time: the *Simplices* were the characteristic ferns of the primary rocks, though many of that type still survive; the *Mixtæ* are the dominant ferns of the present day, while the *Gradatæ* take a middle place."

The scheme on p. 653, showing the approximate relations of the several families of ferns, will be of great service to students of this class (now more important than ever to the morphologist). Altogether, the author's account of the *Filicales* is no doubt the best yet published.

The concluding part of the book gives a full and final statement of the author's theoretical position, and is the part which will most appeal to the reader whose interest lies mainly in the theory rather than the details. Enough, however, has been said on the points in dispute; any attempt at a full discussion would far exceed the limits of a review.

The book is excellently got up, with abundant and admirable illustrations throughout. It is almost free from misprints. One, however, occurs in an important passage on p. 237, where "*Riccia* cell" appears to be a printer's error for "*Ricciaceæ*."

Nothing can be better for English botany than the appearance of such a book as this, a full and most original treatise on an important branch of the science by one who is an acknowledged master of his subject. Prof. Bower is to be warmly congratulated on this, the latest product of his energy and devotion to research.

D. H. S.

WINDMILLS AND WATER-WHEELS.

Natural Sources of Power. By R. S. Ball. Pp. xvi+348. (London: A. Constable and Co., Ltd., 1908.) Price 6s. net.

THE classification of a source of power as a "natural" one is purely arbitrary. The distinction would imply that a source of power could be "artificial," which would, of course, contradict the first law of thermodynamics. The author of the present volume simply uses the word to describe those sources of power which provide us directly with mechanical energy without any intermediate transformation, such as combustion or the like; and the two particular supplies of energy to which attention is directed are wind-power and water-power.

As is natural, the author commences his book with a reference to the, said to be, not distant day when all the coal, and all the oil, in the world will have been used up, and mankind, in order to sustain itself, will have to rely wholly upon the water-wheel and the windmill for that tremendous amount of energy which will be necessary to keep the immense population of the earth in the state of comfort to which it has, with the progress of civilisation, attained. It is an interesting speculation to picture to oneself what the state of the world will be when this prophesied day arrives, and the coal-measures of the world have

disappeared. Will the great manufactures migrate from Lancashire and Northumberland to Norway, Italy, and the West of Ireland, or will, ere that day arrives, our cotton mills and blast furnaces be run by radium engines, utilising sources of energy which are at present wholly unexploited? Certainly, nobody who has studied the development within the last few years of the science of radio-activity will be prepared, out of hand, to deny the possibility.

It is rather surprising to be told that the demand for windmills was never so great as it is to-day, or the trade of the manufacturer of such motors never so brisk. On the other hand, evidences of the utilisation of the water-powers of the world are everywhere abundant, the chief agent in this being the development of electrical technology. A book, therefore, such as the one under review, dealing with these subjects in an easily understandable manner, is to be accorded a welcome. The style of the book, while being simple, is yet not entirely popular. It is not a complete treatise, a certain amount of elementary mathematics is necessary, but the calculus is not used, the author giving a general review of his subject, with the object of showing the desirability of not allowing the many small sources of wind- and water-power which exist to run to waste. The book can be specially recommended to those readers who, while not being specialists in the particular branch dealt with, desire to obtain a general survey of the subject.

The first chapter deals with general principles, such as the distinction between "power" and "energy," efficiency of machines, units, &c. The discussion of the electrical units of energy on p. 7 is hardly happy. This, we think, is due to the author placing in juxtaposition the "foot-pound" and the "watt," which latter, he says, is "allied to a power unit." The confusion in electrical units of power, which the author mentions, is, we think, entirely of his own creation. The watt is not "allied" to a power unit, but is actually the electrical unit of power, there being really no confusion in the matter at all.

Chapter ii. is concerned with "water power and methods of measuring." As is only fit, the fundamental theorem of Bernoulli, which says that the sum of the pressure head, the velocity head, and the height above datum level is the same at all points in a pipe running full of water, is stated and discussed, as are also weirs and the general principles of surveying as called for in the lay-out of a water development scheme.

Subsequent chapters deal with the different kinds of water-wheels and hydraulic turbines, their general design, theory and regulation. The construction of water-power plants and the fundamental principles of dams are also referred to, while descriptions of several typical installations working under such widely different conditions as heads of 2 feet and 2000 feet are given.

The last 120 pages of the volume discuss windmills and wind-motors. It is stated that there is a rapid extension and enormous trade done in small windmills. These are used chiefly in the great agricultural countries for pumping purposes, and the attempt made to utilise such motors for driving electrical generators

has not met with any serious measure of success. It would appear that wind-motors have not yet been subjected to much scientific study. As regards the old type of windmill with four sails, as is usually seen in the eastern counties of England, the rules given by Smeaton in the year 1759, as the result of experiments, embody the chief data available.

The modern or "American" windmill forms the subject of the last two chapters. Many interesting constructional details are given, as well as particulars of tests on the power developed and the cost thereof when applied to different industrial purposes. These chapters can be recommended to those who desire to acquaint themselves with this somewhat out-of-the-ordinary branch of modern mechanics. C. C. G.

NEUROLOGY.

Functional Nerve Diseases. By A. T. Schofield. Pp. iv + 324. (London: Methuen and Co., n.d.) Price 7s. 6d. net.

DURING recent years Dr. Schofield has written many books on different forms of nervous disorder, but the present volume is one of the most interesting. Here he deals with the so-called "functional" nerve diseases. This term "functional," although open to many objections, is a useful one, for by it we can convey that the ailment in question belongs to that class of disease which is independent of gross morbid anatomy changes. The author states it thus:—"that organic changes exist when life has passed but functional changes have then all disappeared." Later, he goes on to say that "disease, *au fond*, has always a material basis, whether recognisable or not, and 'functional' and 'organic' are but expressions of our ignorance that will one day be superfluous." The "Psychology of the Brain" is the subject-matter of one of the opening chapters. Dr. Schofield does not attempt to go deeply into any psychological problems; in truth, he deals with this subject almost too widely to be entirely helpful to the reader. He divides the brain into three main divisions:—(1) The cortex, as the seat of the spirit or directing intelligence; (2) the mid-brain, the seat of the soul or the mere active animal life; (3) the lower-brain, which is the seat of the body or the mere physical existence. The author definitely states that he writes this book from the dualist standpoint; "that is, in the belief that mind is not the product of matter, but distinct from it, and that life is mind in action." He urges upon the student to get rid of the idea that *consciousness* is mind or that it is the only proof of mind. "Mind," he writes, "may be conscious, subconscious, or unconscious." But he only uses these terms provisionally until it is possible for the student to understand that mind means *all* mind, and not only that part of it which we choose to call consciousness. When discussing the general ætiology of functional nerve diseases Dr. Schofield writes:—

"In functional disease the underlying change is often in the association of cells rather than their structure, for we must remember that the association of neurons is not organic but functional."

He deals with the varied recognised factors in the causation of this class of disorder, and among these he mentions the influence of "suggestion." This, he says, may be from oneself (auto-suggestion) or from others, but the former is the more frequent. When treating with the causes of hysteria, the author recites the various views held by recognised writers. He regards "heredity" as the principal and general predisposing cause of neurasthenia, a prominent factor being alcoholism in the ancestry of the patient. The author gives a useful chapter on the symptoms of neurasthenia, but he adds nothing new to the subject. When dealing with "psychotherapy" the various objections to it in this country are referred to, and Dr. Schofield evidently deplores that the influence of the mind over the body is not more fully taught to students at the hospital. He denies that "suggestibility" is a symptom of hysteria, as taught by Charcot, and points out that it is often easiest in the sound and the sane, more difficult in the neurasthenic or hysteric, and almost impossible in the insane. We do not agree with the views that he expresses on the importance of massage in all cases, for we are convinced that this treatment is very harmful to some patients as merely increasing the nervo-muscular irritability. Taken as a whole, the book is well written and full of useful information, and it will be found to contain many suggestions which will prove of value to the thoughtful student.

OUR BOOK SHELF

Trout Waters: Management and Angling. By Wilson H. Armistead. Pp. x+203. (London: Adam and Charles Black, 1908.) Price 3s. 6d. net.

THIS is a pleasantly discursive little book, which is obviously based upon considerable personal observation and experience on the part of the author. We doubt, however, whether Mr. Armistead was altogether wise in avoiding all books of reference, as he states himself to have done; a book of reference would have prevented the same mollusc from figuring as "*Limnaeus peregra*" and "*Limnea*" in consecutive paragraphs.

The advice given as to improving and protecting trout in various waters is on the whole sound and sensible; the suggestions that minnows introduced to feed large trout may seriously compete with smaller trout for the available food supply, and that eels are dangerous enemies of the ova and fry of trout and may do more harm than pike or perch, are fair examples of the many practical matters touched upon. It is a pity that no directions are given as to simple and inexpensive forms of hatching apparatus, such as Herr Jaffé's "floating redd," which would seem well suited for use in many such waters as are considered in the work now under consideration.

It is when Mr. Armistead touches upon the natural history of the Salmonidæ that the lack of books of reference is most apparent. The statement that "fry hatched from eggs taken from wild parents are, though strong and healthy, difficult to rear on account of their inherited wildness" is somewhat startling. A chapter is devoted to the consideration of the question whether the presence of trout in a salmon river is or is not a disadvantage, and the question is treated in a thoughtful manner; it is, however, a little surprising to learn, not only that migratory